

**DETAILED ACTION**

**Remarks**

1. The After Final Amendment filed on August-16-2007 has been received and entered. Claims 3, 9-10, 12, 14, 16-17, 21, 27-28, and 30 are pending.

**EXAMINER'S AMENDMENT**

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Gregory P. Durbin (Attorney of Record) on August 27, 2007 and September 7, 2007.

**Amendments to the Claims:**

3. The claims has been amended as follows:

Replace claim 3 with the following:

Claim 3 (Currently Amended): In a storage network, a method to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first electronic device in said storage network to log one or more writes to a local storage device only when said first replica held by

said physically remote storage device is unavailable due to a detected error condition in the storage network;

determining at said first electronic device when said detected error condition no longer exists in the storage network;

upon determination that said detected error condition no longer exists, instructing said first data replication facility of said first electronic device to replicate data corresponding to the one or more writes identified in said log to generate a second replica;

automatically outputting said second replica in accordance with a communication protocol from said first electronic device to a second data replication facility of a second electronic device of said physically remote storage device in said storage network to update said first replica at the physically remote storage device; ~~and~~

~~instructing said first data replication facility of said first electronic device to automatically output said second replica to said second replication facility once generation of said second replica is complete.~~

Replace claim 9 with the following:

9. (Currently Amended) In a storage network, a method to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first electronic device in said storage network to log one or more writes to a local storage device only when said first replica held by said physically remote storage device is unavailable due to a detected error condition in the storage network;

determining at said first electronic device when said detected error condition no longer exists in the storage network;

upon determination that said detected error condition no longer exists, instructing said first data replication facility of said first electronic device to replicate data corresponding to the one or more writes identified in said log to generate a second replica;

synchronously outputting said second replica in accordance with a communication protocol from said first electronic device to a second data replication facility of a second electronic device of said physically remote storage device in said storage network to update said first replica at the physically remote storage device. ; and

~~wherein said outputting from said first data replication facility of said first electronic device to said second data replication facility of said second electronic device occurs in a synchronous manner.~~

Replace claim 10 with the following:

10. (Currently Amended) In a storage network, a method to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first electronic device in said storage network to log one or more writes to a local storage device only when said first replica held by said physically remote storage device is unavailable due to a detected error condition in the storage network;

determining at said first electronic device when said detected error condition no longer exists in the storage network;

upon determination that said detected error condition no longer exists, instructing said first data replication facility of said first electronic device to replicate data corresponding to the one or more writes identified in said log to generate a second replica;

outputting said second replica in accordance with a communication protocol from said first electronic device to a second data replication facility of a second electronic device of said physically remote storage device in said storage network to update said first replica at the physically remote storage device; and

wherein said communication protocol comprises the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite.

Replace claim 12 with the following:

12. (Currently Amended) In a storage network, a method to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first electronic device in said storage network to log one or more writes to a local storage device only when said first replica held by said physically remote storage device is unavailable due to a detected error condition in the storage network;

determining at said first electronic device when said detected error condition no longer exists in the storage network;

upon determination that said detected error condition no longer exists, instructing said first data replication facility of said first electronic device to replicate data corresponding to the one or more writes identified in said log to generate a second replica;

outputting said second replica in accordance with a communication protocol from said first electronic device to a second data replication facility of a second electronic device of said physically remote storage device in said storage network to update said first replica at the physically remote storage device; and

wherein said log comprises a bitmap holding one or more bits, wherein each of the one or more bits in the bit map indicates a storage location written to on the local storage device.

Replace claim 14 with the following:

14. (Currently Amended) In a computer network having a plurality of programmable electronic devices, wherein each of said plurality of programmable electronic devices operates as a host device for a data replication facility for replicating data among said plurality of programmable electronic devices, a method to handle a communication link failure in said computer network, said method comprising the steps of:

instructing each said data replication facility of each of said plurality of programmable electronic devices to enter a logging routine only when said host device of said data replication facility detects said communication link failure, wherein said logging routine halts said replicating of data by said replication facility of said host device and said replication facility of said host device identifies in a log each local write of said host device that detects said communication link failure;

instructing each said data replication facility of each of said plurality of programmable electronic devices that initiated said logging routine to generate a replica for each said local write identified in said log upon reestablishment of said communication link;

grouping each said replica into a single data set; and  
forwarding said single data set in accordance with a communication protocol from a first of said plurality of programmable electronic devices to a second of said plurality of programmable electronic devices.

Replace claim 21 with the following:

21. (Currently Amended) A computer readable medium holding programmable electronic device readable instructions executable to perform a method in a storage network to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first programmable electronic device in said storage network to enter a first state to log, one or more writes to a local storage device only when said first replica held by said physically remote storage device is unavailable due to a detected error condition that does not allow transmission of data to said physically remote storage device;

determining at said first programmable electronic device when said first replica held by said physically remote storage device is available due an abatement of the detected error condition;

instructing said first data replication facility of said first programmable electronic device to replicate data corresponding to the one or more writes identified in said log ~~in order~~ to create a second replica upon determination by said first programmable electronic device that said first replica held by said physically remote storage device is available;

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automatically outputting said second replica in accordance with a communication protocol from said first programmable electronic device to a second data replication facility of a second programmable electronic device in communication with said physically remote storage device in said storage network to update said first replica at the physically remote storage device; and

~~instructing said first data replication facility of said first programmable electronic device to automatically transmit said second replica to said second replication facility once creation of said second replica is complete.~~

Replace claim 27 with the following:

27. (Currently Amended) A computer readable medium holding programmable electronic device readable instructions executable to perform a method in a storage network to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first programmable electronic device in said storage network to enter a first state to log, one or more writes to a local storage device only when said first replica held by said physically remote storage device is unavailable due to a detected error condition that does not allow transmission of data to said physically remote storage device;

determining at said first programmable electronic device when said first replica held by said physically remote storage device is available due an abatement of the detected error condition;

instructing said first data replication facility of said first programmable electronic device to replicate data corresponding to the one or more writes identified in said log ~~in order~~ to create a second replica upon determination by said first programmable electronic device that said first replica held by said physically remote storage device is available;

synchronously outputting said second replica in accordance with a communication protocol from said first programmable electronic device to a second data replication facility of a second programmable electronic device in communication with said physically remote storage device in said storage network to update said first replica at the physically remote storage device; and

~~wherein said outputting from said first data replication facility of said first programmable electronic device to said second data replication facility of said second programmable electronic device occurs in a synchronous manner.~~

Replace claim 28 with the following:

28. (Currently Amended) A computer readable medium holding programmable electronic device readable instructions executable to perform a method in a storage network to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first programmable electronic device in said storage network to enter a first state to log one or more writes to a local storage device only when said first replica held by said physically remote storage device is unavailable due to a



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detected error condition that does not allow transmission of data to said physically remote storage device;

determining at said first programmable electronic device when said first replica held by said physically remote storage device is available due an abatement of the detected error condition;

instructing said first data replication facility of said first programmable electronic device to replicate data corresponding to the one or more writes identified in said log ~~in order~~ to create a second replica upon determination by said first programmable electronic device that said first replica held by said physically remote storage device is available;

outputting said second replica in accordance with a communication protocol from said first programmable electronic device to a second data replication facility of a second programmable electronic device in communication with said physically remote storage device in said storage network to update said first replica at the physically remote storage device; and

wherein said communication protocol comprises the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite.

Replace claim 30 with the following:

30. (Currently Amended) A computer readable medium holding programmable electronic device readable instructions executable to perform a method in a storage network to update a first replica held by a physically remote storage device in said storage network, said method comprising the steps of:

instructing a first data replication facility of a first programmable electronic device in said storage network to enter a first state to log, one or more writes to a local storage device only when said first replica held by said physically remote storage device is unavailable due to a detected error condition that does not allow transmission of data to said physically remote storage device;

determining at said first programmable electronic device when said first replica held by said physically remote storage device is available due an abatement of the detected error condition;

instructing said first data replication facility of said first programmable electronic device to replicate data corresponding to the one or more writes identified in said log ~~in order~~ to create a second replica upon determination by said first programmable electronic device that said first replica held by said physically remote storage device is available;

outputting said second replica in accordance with a communication protocol from said first programmable electronic device to a second data replication facility of a second programmable electronic device in communication with said physically remote storage device in said storage network to update said first replica at the physically remote storage device; and

wherein said log comprises a bitmap to hold one or more pointers, wherein each of the one or more pointers indicate a location on a storage device written to during said first state.

*Allowance*

4. Claims 3, 9-10, 12, 14, 16-17, 21, 27-28, and 30 are allowed over the prior art made of record.

Ganesh et al. (U.S. Patent No. 6,691,139 B2) teaches actively and continuously logging all transactions in a local log.

Wahl et al. (U.S. Patent No. 6,324,654 B1) teaches remote data mirroring.

Fall et al. (U.S. Patent No. 5,991,771) teaches synchronization in disconnectable computers and network.

M. Satyanarayanan et al. USENIX Mobile & Location Independent computing symposium. Paper. August 2-3, 1993.

All prior art of record including Ganesh et al., Wahl et al., Fall et al., and M. Satyanarayanan et al. does not disclose, teach, suggest, or make obvious the claimed limitations of (in combination with all other features in the claim), "Log one or more writes to local storage device only when said first replica held by physically remote storage device is unavailable due to network error condition", as claimed in Independent claims 3, 9, 10, 12, 14, 21, 27, 28, and 30.

All dependent claims are allowed over the prior art made of record, because it is dependent from the allowed independent claims.


5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

*Conclusion*

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Neveen Abel-Jalil whose telephone number is 571-272-4074. The examiner can normally be reached on 8:30AM-5:30PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey A. Gaffin can be reached on 571-272-4146. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
/Neeven Abel-Jalil/  
Primary Examiner  
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